

# **Effective Organization of Instructional Time in a Content Mastery Math Resource Room for Students with Learning Disabilities**

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## **Abstract**

This manuscript explores three levels of intervention that aid in efficient use of instructional time for the math resource room. The resource room used in this action research project is representative of the Content Mastery (CM) Class, an emerging curricular model. The CM class is subject specific with explicit instructional goals including identifying and addressing individual student deficits, progress monitoring, and supporting skills taught in the general education classroom. Math interventions in the CM class include Level I: Curriculum Based Measurement, Level II: peer tutoring in a Facts Fluency program, and Level III: math vocabulary and journaling. The use of several instructional approaches that are proven effective with students who are at-risk for school failure is investigated.

## **Introduction**

According to the National Assessment Education Progress (NAEP, 2005) data, less than one-quarter of high school seniors scored proficient or above and less than one-fifth of 12<sup>th</sup> grade students with disabilities scored at the basic level on the 2005 mathematics assessment. Moreover, 49% of seniors without disabilities, and more than 80% of students with disabilities scored below basic (NAEP, 2005). Concerns over student performance in schools have initiated several accountability initiatives whereby schools are required to report performance on end of year assessments. The No Child Left Behind Act (NCLB) requires all students to reach high standards of proficiency or better in reading and mathematics by the year 2014 (Public Law No.107-110).

Principals and teachers are under unprecedented demands to improve the academic performance of *ALL* children, especially in the area of mathematics. Proficiency in mathematics depends on a continuous development and blending of intricate combinations of various critical component skills. Gaps in any of these component skills will cause students to struggle in many aspects of their mathematics education. The difficulties experienced by teachers and students in math are particularly unique because the mathematics continues to build as students advance through grade levels. With limited instructional time in the school day, teachers must use their time efficiently and effectively to make every minute count. The increased use of evidenced-based instructional strategies and approaches are critical to the overall math success of students with disabilities. In response, schools are actively pursuing a variety of efforts including emphasis on early numeracy development (e.g., number sense), improved math curriculum, formative assessment systems, summer programs, increasing after school tutoring programs, and improved parental involvement to increase the number of students with disabilities scoring at proficient.

Middle and junior high schools serve as a critical bridge between elementary and secondary years. For students who aim to graduate high school with a diploma, this is the time to close the achievement gap before students encounter the high stakes of Carnegie Units. There is a great amount of variance from school to school on how to meet the demands placed on middle and junior high schools. Examples include after school tutoring, during school tutoring (pulling students out of extra-curricular subject time), extrinsic rewards for improved performance, etc.

There is also variability in scheduling and choice of instructional model. However, existing educational models can fail to provide students with disabilities the amount of instructional time and the individual attention necessary to be successful. As a result, a new educational model is emerging. A double blocking or double dosing curricular design is an increasing trend among middle and junior high schools. Identified by educators in upstate South Carolina as the Content Mastery (CM) model, this arrangement provides students with disabilities additional content specific instructional time. For example, if a student's IEP specifies additional services in the area of math, the student is scheduled to receive instruction in the general education classroom plus an additional CM class devoted exclusively to math. The CM class is subject specific with explicit instructional goals including identifying and addressing individual student deficits, progress monitoring, and supporting skills taught in the general education classroom.

The purpose of the CM model is threefold. First, a major emphasis is to provide instruction on essential math skills that students have not learned or lack for overall math improvement. Second, student progress is monitored through formative measures to allow for informed data-based instructional decisions. Third, instructional support with the current content being taught in the general education classroom is provided.

A CM Class differs from the mainstreamed and inclusion classroom models because the special education and general education teachers serve equal roles. In a mainstreamed classroom model, progress of students with disabilities is viewed as the primary role of the special education teacher. In an inclusion classroom model, the general education teacher assumes primary responsibility for student progress (Jobe, Rust, & Brissie, 1996). The CM model merges these two educational genres; general and special education teachers collaborate for planning and teach separate lessons on the same or similar topics and skills. Initial reports from schools who use a similar model are promising (e.g. Center on Educational Policy, 2005), but the CM model has not yet been comprehensively evaluated.

In order to improve mathematical programs for students with disabilities, the specific instructional and content needs must first be considered. Students need to find meaning in math and perform the skills in ways that apply to their lives. The challenge lies in tailoring instruction to do this while also meeting their learning needs (Allsopp, 1999). In a discussion on the ethical obligation for improving the education of at-risk children, Siegfried Engelmann (2005) stated, "We can't lead with our chin or our hearts. It must be a cerebral battle, governed by data and the understanding that if we try hard enough, we can design effective practices that will accelerate the performance of at-risk kids. And if we don't try hard enough, the hell with us." In this article, the use of several instructional approaches that are proven effective with students who are at-risk for school failure is investigated. It is a goal for this research to lead to *best practice* for scheduling the instructional time within the Content Mastery model.

### **Location and Participants**

This action research project was completed in a junior high with school demographics representative of those in the community: 77% Caucasian, 13% African American, 6% Hispanic, and 3% Asian. Thirty-six percent of students receive free or reduced lunch. Approximately, 11% of students receive special services and 16% are served as Gifted and Talented. An additional 109 students are served through the ESOL program. The specific interventions detailed in this study took place in a CM classroom focused solely on math instruction. Classes range in size from 4-10 students; grouped by grade level. The methods incorporated in the instructional routine of the CM classroom were organized around three levels of instructional supports. The first level consisted of progress monitoring procedures based on curriculum-based measures (CBM) for computation. The second level focused on students' automaticity, both accuracy and

fluency, of basic math facts and was instructed using a peer-assisted facts fluency program. The third level included vocabulary instruction taught in isolation and then within context of daily journaling activities. A discussion of implementation and recommendations follows the summary of research.

### **Level I- Curriculum-Based Measurement**

There are many benefits of utilizing CBM procedures to inform instructional decisions. It is an efficient way to produce accurate, meaningful information on student academic performance and growth. CBM aids in answering questions on the effectiveness of instructional programs in producing academic growth, and provides information to help teachers improve their instructional programs (Deno, Fuchs, Marston, & Shin, 2001). Many educational experts advocate monitoring student performance, communicating progress to students and parents, and reinforcing success on a continual basis (see Hosp, Hosp, & Howell, 2007). Utilizing these strategies properly to inform instruction can result in increased learning outcomes in mathematics (Miller & Mercer, 1997).

CBM was the first level of interventions incorporated in the CM classroom's instructional routine. Following the model described by Hosp & Hosp (2003), students were tested using computational probes for three minutes. Correct digits were counted and summed to find the total correct digits. Once a student had three baseline points in their instructional zone, median scores were used to calculate each student's current level of performance. Individual goals were determined by multiplying the growth rate, the number of correct digits growth in a week, by the instructional period, then adding the original correct digits score. The goal is based on the skills and level of curriculum the student is expected to be successful at approximately one year above the level at which the student is instructed, not necessarily their current grade level. An aimline was drawn on the graph from the first data point to the goal at the end of the instructional period. Thirty different but equivalent math computation probes on each student's instructional level were used to monitor progress throughout the year. When three or more consecutive data points were below the goal line, instruction was adjusted accordingly.

Explaining the purpose of CBM facilitates improved self-regulating behaviors essential for life-long learning. Students can easily and clearly visualize their mathematical performance through a graphic display much easier than trying to make sense of scores such as below basic, basic, proficient, and advanced. Additionally, having students set goals is self-motivating and allows them to take ownership of their performance. Teachers also make informed instructional decisions based on student progress when using CBM data.

### **Level II- Fact Fluency program**

After CBM became a standard part of the classroom routine and baseline data points were graphed, it became evident the instructional program needed supplementing in the area of basic facts and computation. Examining the completed probes clearly documented student deficits in the area of basic facts (e.g., addition, subtraction, multiplication, and division) as well procedural computational errors. Anecdotal information gathered from observing students completing the probes verified computational errors and student frustration in these areas. Based on visual examination of students' graphs, error analysis of completed probes, and informal observations, a peer-assisted math fact fluency program was implemented.

It is a well known fact students with learning disabilities tend to struggle with the automatic recall of basic math facts (Gersten & Chard, 1999). This knowledge discrepancy is seen in students as young as seven years old and tends to continue, even into high school. On average, children with disabilities know one third the math facts as their peers without disabilities. By the time they reach middle school, a sizable gap exists between the knowledge held and the knowledge needed for success in a general education program. Like a set of

dominoes, knowledge or the lack of knowledge in math facts greatly influences a student's academic career, and eventually his/ her life after school.

Crawford (2002) identifies five reasons for teachers to include fact fluency lessons in their daily routine. Using a calculator correctly, estimating to identify whether answers make sense, and eventual mastery of fractions are included, but the most obvious reason is best described through the following scenario. Mastery of facts leads to mastery of fractions; mastery of fractions leads to the ability to pass algebra; passing algebra leads to higher math classes; higher math classes lead to high school graduation and post-secondary schooling.

Most teachers assume automaticity of math facts when teaching the standards (NCTM or state) thus causing the comprehension of calculations and larger concepts to be limited (Gersten & Chard, 1999). When this assumption is made, the foundation for understanding mathematical conversation is not present. Gersten's theory explains the mind as having a limited capacity for information processing. It is proposed that with automaticity of facts, the freed attention can be allocated to other tasks and processes (Cumming & Elkins, 1999). When math facts become cognitively automatic, students can better attend to higher-order thinking. Higher levels of thought are required for math content in the middle school, another reason for incorporating a facts fluency program in the level II intervention. The specific program implemented was Mastering Math Facts from the Otter Creek Institute (<http://www.oci-sems.com>). This is a cooperative learning program that can be used in whole class or small group instruction. The optimal choice is for students to work in pairs; one student as a checker and one student as a learner. All students have copies of answer keys for their job as a checker. A paper divided into two sections is used for each session; a top section for oral practice and a bottom section for daily assessment. The learner in each pair reads the math facts from the top section to the checker, who is following along on the answer sheet. If the learner makes a mistake or hesitates, the checker stops them and tells the correct answer. The learner then repeats the correct answer and moves back three problems. Students are encouraged to move quickly through the facts on each sheet to allow for maximum practice. This procedure is followed for a two to three minute session, and then the partners switch roles. Once each student had an opportunity to practice the facts, all students participate in a one minute timed test located at the bottom half of the sheet. If students meet their predetermined goal, they color in their graph and move to the next level. If the goal is not met, the student stays on the same level until the goal is met.

### **Level III- Math Vocabulary and Journaling**

Mathematics can be very challenging for students with disabilities because of the complexity of its atypical terminology (Harmon & Hendrick, 2005). The language of math includes words, numbers, and symbols. At times, these are interrelated and interdependent, and at other times disjointed and autonomous (Adams, 2003). Mathematics is a language of order with its own particular set of rules that must be learned and followed systematically. Adams suggests one plausible reason for student weaknesses in math ability is often due to focusing on and interpreting the language. Another reason for difficulty is many students who have a disability in math also experience reading difficulties that interfere with their ability to solve problems (Miller & Mercer, 1997). The presence of more than one disability compounds the problem for many students. A third reason for difficulty in mathematics is many students with math disabilities lack a sense of what numbers mean.

Number sense, usually acquired informally before kindergarten, is a key ingredient to the ability to solve basic arithmetic computations (Gersten & Chard, 1999). Number sense is related to the semantic representation of information (the language of math) rather than a procedural deficit. This representational problem can lead to procedural difficulties in new problem-solving situations (Woodward & Baxter, 1997). Most importantly, number sense is a prerequisite for

later mathematics and positive attitudes towards math in general. Students who lack number sense lack the ability to perform mental mathematics or look at the world and make comparisons (Berch, 2005). This ability deficit creates a challenging educational situation for teachers, especially in inclusive classrooms. The incorporation of journaling activities twice a week provides students an opportunity to practice reading and using the language of math while also engaging students in the application of number sense. Students are given prompts with specific words to use in their writing.

## **Results**

Visual inspection of the student progress monitoring graphs demonstrated adequate rates of growth across mathematical computation. Student progress in overall mathematical performance was evident from other informal and anecdotal sources such as student journals, test grades, improved attitudes towards math, and passing grades from the general education math teachers. Additionally, student CBM graphs showed academic growth for all participants with some students progressing across grade levels. The increase in student confidence was dramatic and positively influenced students' perception of their own math abilities.

Students also demonstrated growth using the facts fluency instructional program. Crawford (2002) states, "Starting in fourth grade, multiplication has priority." Because of this precedence, all students in the experimental classroom began with multiplication facts. This program allows for student progress at individual rates. While all students have demonstrated growth, 12% have progressed to division facts.

Teacher observations in both the CM classroom and the general education math class show a marked increase in student participation and self-confidence in their mathematical abilities. Before implementation of these instructional strategies, students were more inclined to listen to instruction, but not actively participate. Post-implementation observations tell of students being excited that they are among the first in class to answer computational problems including multiplication. The overall classroom milieu is evolving in a positive way.

## **Recommendations**

Schools that wish to implement a CM model should consider the following three recommendations in regard to (a) scheduling, (b) pacing, and (c) placement. Scheduling properly is a crucial element to facilitate an efficient classroom environment. When scheduling students with disabilities to general education teams, schools should consider placing students from the same team in the same class with the resource teacher. This type of scheduling facilitates the consistent planning, teaching, and evaluating of students math performance.

Pacing of content is a concern when considering the instruction of students with disabilities. The general education classroom in this instructional model includes a heterogeneous mix of students. Some students will master concepts quickly, and other students will need more instructional time. The CM and general education teachers need to work together to determine a pace that is acceptable for students who struggle to learn math content; yet, sufficiently challenging for typically performing students.

In consideration of the CM model, schools must consider the entire spectrum of special services (consultative, itinerant, resource, self-contained, etc.) Students with disabilities have a legal right to receive a free, appropriate, public education in the least restrictive environment (Gartin & Murdick, 2005). The word *appropriate* is the crucial component here. Not all children with disabilities may excel in CM model. Some students will still need more interventions; some will need less. Schools need to consider and provide all options along the continuum of services for student placement.

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